

DOCUMENT RESUME

ED 253 552

TM 850 089

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TITLE Concurrent, Differential, and Construct Validities of Technical Report.
INSTITUTION Ball Foundation, Glen Ellyn, IL.
REPORT NC BF-TR-5
PUB DATE Jun 84
NOTE 56p.
PUB TYPE Statistical Data (110) -- Reports -- Research/Technical (143)

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS *Academic Achievement; *Aptitude Tests; Correlation; High Schools; Occupational Tests; Postsecondary Education; Predictive Validity; *Racial Differences; *Sex Differences; *Socioeconomic Status; *Test Validity; Vocational Aptitude

IDENTIFIERS American College Testing Program; *Ball Aptitude Battery; Differential Aptitude Tests

ABSTRACT

This study was part of a longitudinal research project to establish the validity of the Ball Aptitude Battery (BAB) relative to various academic criteria. The BAB is a multiple ability test battery of specific work skills for use in career counseling. Previous research has demonstrated that adequate validity coefficients exist for both job performance criteria and training criteria. Using data from 976 high school seniors, the purposes of the present study were: (1) to assess if level differences in performance exist on the BAB and on the ten academic criteria across sex, race, and socioeconomic status; (2) to determine the concurrent validity of the BAB against academic performance in ten high school subject areas; (3) to examine the differential validity of the BAB relative to various sex and ethnic groups; and (4) to investigate the construct validity of the BAB by comparing it to similarly available tests--the Differential Aptitude Test (DAT) and the American College Test (ACT). Two additional but minor objectives of the study were: (1) to derive an empirical data-based socioeconomic status; and (2) to determine the best linear combination of BAB tests to predict success in four major academic areas (English, math, social studies, and natural science). (BS)

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TECHNICAL REPORT

UNCLASSIFIED, DIFFERENTIAL, AND CONFIDENTIAL
OF THE BALL FOUNDATION TEST (1961)

Thomas L. Davis
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The Ball Foundation

BF-TR-4
June 1961

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BALL FOUNDATION

Research in development of human potential

Technical Report No. 5

CONCURRENT, DIFFERENTIAL, AND CONTRUCT VALIDITIES
OF THE BALL APTITUDE TEST (BAB)

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Differential, Concurrent, and Construct Validities
of the Ball Aptitude Test (BAB)

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INTRODUCTION

This study is part of a large scale longitudinal research project aimed primarily at establishing the validity of the Ball Aptitude Battery (BAB) relative to various academic criteria. Previous research on the BAB (Sung, 1979) has demonstrated that adequate validity coefficients exist for both job performance criteria and training criteria. Significant job related validity coefficients have been obtained for certified public accountants, bank tellers, clerks, and gum sticker, puller, and harvesters. Furthermore, concurrent validation using training criteria have shown significant correlations of the BAB with success in horticultural training and in a carpenter training program.

The purposes of the present study are (a) to assess if level differences in performance exist on the BAB and on the ten academic criteria across sex, race, and SES. Level differences are examined in terms of sex, socio-economic status, location, and ethnic group comparisons, (b) to determine the concurrent validity of the BAB against academic performance in ten high school subjects areas, (c) to examine the differential validity of the BAB relative to various sex and ethnic groups, and (d) to investigate the construct validity of the BAB by comparing it to similarly available tests - the Differential Aptitude Test (DAT) and the American College Test (ACT).

Two additional but minor objectives of the study are (a) to derive an empirical data based socio-economic status and (b) to determine the best linear combination of BAB tests to predict success in four major academic areas.

METHOD

Instruments

The ability dimensions involved in this study were measured with the Ball Aptitude Battery (BAB), a multiple aptitude battery developed by the Ball Foundation, Wheaton, Illinois. This battery consists of fifteen tests which have been redeveloped and refined from the original series of tests of Johnson O'Connor (O'Connor, 1935) which used the "work sample" approach. The tests were designed to serve as reference dimensions for the description of specific work skills (Fleishman, 1967), and therefore, to serve as measures of aptitudes for such skills.

The BAB consists of the following tests:

1. Clerical (C): Measures the ability to perceive visual details, similarity and differences; a measure of perceptual speed and accuracy.
2. Idea Fluency (IF): Measures the ability to produce ideas of alternative uses of a given object; a measure of creativity component.
3. Tonal Memory (TM): Measures the ability to remember a series of tones. As with pitch discrimination, this is an important measure of auditory aptitude.

4. Pitch Discrimination (PD): Measures the ability to differentiate between tones varying in pitch; an element of auditory ability.
5. Rhythm Memory (RM): Measures the ability to differentiate between two rhythmic pattern varying in rhythms (adapted from the Seashore Measures of Musical Talents with permission from The Psychological Corporation).
6. Inductive Reasoning (IR): Measures the ability to identify a rule; to reason from some specific information to a general principle.
7. Word Association (WA): Measures the similarity of response to the normative word-association response.
8. Writing Speed (WS): Measures the ability to write fast.
9. Paper Folding (PF): Measures the ability to visualize in two dimensional space.
10. Vocabulary (V): Measures the ability to choose the right word that represents an idea; knowledge of the English vocabulary.
11. Ideaphoria (IP): Measures the ability to generate a rapid and abundant flow of words and ideas; a measure of expressional fluency of words and ideas.

12. Finger Dexterity (FD): Measures the ability to make skillful, controlled manipulations of small objects, principally involving finger movement. Two scores are reported representing the ability with the left (FD-L) and the right (FD-R) hand.
13. Grip (G): Measures the strength of grip. Two scores are reported representing the ability with the left (G-L) and the right (G-R) hand.
14. Shape Assembly (SA): Measures the ability to visualize in three dimensional space.
15. Analytical Reasoning (AR): Measures the ability to reason from a general principle to specific information and from specific examples to a general principle; the ability to organize related concepts in a systematic way.

Administration time for the battery is approximately 3-1/2 hours. The tests are given in two sessions. The group tests are usually administered to a group of about 30 persons. Individual testing sessions are scheduled for one hour, although these tests may be completed in as little as thirty minutes. The individually administered tests include Analytical Reasoning, Shape Assembly, and Grip. The rest of the battery are group administered.

Table 1 provides details regarding the number of items, scoring instructions, and maximum score possible for each BAB test.

Insert Table 1 About here

Sung and Dawis (1979) reported "The mean six weeks test-retest reliability for the BAB tests --- obtained by transforming all reliabilities to Fisher's Z_r values, averaging, and transforming back to the correlation scale --- was .82 for the total reliability study sample ($N = 261$) .82 for male ($N = 115$) and .81 for female samples ($N = 146$) respectively"

In addition, the criterion measures were obtained from the high school academic transcripts of those students who granted permission to release their records. From each student's transcript, the following courses grades were collected, if available: English, Math, Economics, Biology, Physics, Chemistry, Science Average, Social Studies, Foreign Languages and cumulative grade point average (GPA). At the same time, other test scores available were collected from subjects who had taken the Differential Aptitude Test (DAT) and the American College Test (ACT).

Since the 21 schools sampled varied as to the method of assigning grades, an uniform procedure was adopted to obtain equivalent course grades (regardless of the method used by the individual school): A = 5, B = 4, C = 3, D = 2, F = 1. However, if a GPA score was reported by a school, the school's own weighting system was used.

For each course area, the grades collected represented primarily performance in the senior year. If grades for a particular course had

been collected over several grading periods in the Senior year, then the grades were averaged. If several subjects were taken in the Senior year under the same course title, then the average of the subject grades were taken. For example, if English IV and Journalism were both taken in the Senior year, the average grade of these two subjects was coded in the course category "English". All course averages were rounded to the nearest decimal place.

In some cases, a student may not have taken one of the listed courses in his Senior year. In those cases, the grades of the particular course were taken from the preceding year closest to the Senior year. For example, if no Social Studies course was taken in the Senior year, then the Social Studies course(s) taken in the Junior year were scored and coded. If, for some reason, no Social Studies course was taken in the Junior year, then the Social Studies grade(s) in the Sophomore year was taken. In a few cases, following the above logic, course grades in the Freshman year were coded when grades were not available for a particular course in other years.

The "Science Average" was obtained by adding the grades in "Biology", "Chemistry", and "Physics" and then dividing by three. If grades existed only for two of the above courses, the average of the two course grades were used. If only one course grade was available, that particular grade was used to represent the "Science Average".

Prior to major statistical analysis, each criterion measure was transformed to z scores for each of the 21 sample schools.

A third instrument, a biographical information inventory was filled out by the student at the time of testing. The inventory contained information regarding extra curricular activities as well as career plans, interests, and values. Furthermore, the inventory gathered demographic and socio-economic information. An additional questionnaire was sent to the parents of each student requesting demographic and socio-economic information regarding the family. The parent questionnaire was used for verification and elaboration of the student's response to socio-economic status variables.

Subjects

The subjects participating in the present study consisted of 976 senior high school students in the states of Illinois and Texas. Consent for testing was obtained from the 32 private and public schools. Of the total sample, 801 students from 21 schools agreed to release their transcripts to be used for the validation study and thus comprise the main sample for this study. 84 subjects had previously taken the DAT and 136 had been administered the ACT.

The present study used stratified sampling design which included geographical location, ethnic origin, socio-economic status, and sex as a base of strata. Statistical data used in the sampling was based on the 1970 census results. The sampling unit was the school.

The two states were selected for their representation of ethnic diversity, socio-economic status and sex. The sampling areas were narrowed down to county, city and town levels. According to the 1970 census data, the propor-

tion of urban to rural population was about 80% to 20%. However, it was also indicated that more than 80% of urban population live in the metropolitan and suburban areas of large cities and towns. Therefore, the sampling in this study has been focused upon metropolitan areas rather than rural areas.

The ethnic groups included in the design were Blacks, Whites and Hispanics. Although the proportion of these three ethnic groups reported in the 1970 census was .11, .88, and .05 respectively, the number of subjects sampled in this study has been adjusted to obtain statistically meaningful data. A few subjects did not belong to the three ethnic groups and were designated "Other".

The three levels of socioeconomic status (SES) considered were lower, middle and upper. For the initial sampling plan an SES category was assigned using the median income level of the community for which the school was located. Thus initially all students in a particular school were assigned the same SES category. The initial classification was later refined empirically by applying a factor analytic (i.e. principal axis solution, varimax rotation) method to SES data collected from the students and their parents. The operational definition of final SES was done by arbitrarily placing approximately one third of the students from each region into one of three SES classes.

The number of male and female subjects were approximately equal.

The detailed characteristics of the sample may be found in Table 2. It should be noted that Table 2 also includes the data on total sample including those who did not release their permission.

Insert Table 2 about here

The demographic characteristics of students who agreed to provide their transcripts may be found in Table 3.

Insert Table 3 about here

To examine any potential difference between these two groups, with regard to their sex, race, and location the Chi-square test was performed. The results found no significant differences regarding sex distribution but significant differences at the .01 level with respect to ethnic and location distributions between the two groups. A greater proportion of White students from Illinois did not volunteer to release their transcripts. This apparently was in part the result of a greater willingness among Texas administrators to encourage students to release their transcript information.

Data Analysis

The BAB test protocols were hand scored, the transcripts and inventory were coded, and all were processed for computer analysis. Data analysis was undertaken on a CDC 6700 computer, using SPSS Version 7.0 programs.

Factor analysis was performed on data to derive an empirically based measure of SES. The factoring method used was a principal factors solution with iteration to obtain final communality estimates, followed by a varimax orthogonal rotation.

To determine if level differences existed on the BAB and on the academic criteria, a series of $3 \times 2 \times 2 \times 3$ analyses of variance were performed with socio-economic status, sex, location, and race as independent variables and

each of the BAB's 17 tests and each of the ten academic criteria serving as dependent variables.

The validity of each BAB test against each of the ten academic criteria was computed in two ways, one using the median correlation coefficient, the other computing for the overall correlation coefficients. The two methods applied are not meant to confuse the reader as to the appropriate validity coefficients but rather to allow the reader to examine the results of both methods since various test researchers alternately prefer one method over the other. For both methods, each student's score for each of the ten academic criteria was converted to Fisher's Z-scores for each school separately.

The median validity coefficient reported is simply the middle score obtained when all the schools are ranked from highest to lowest according to the size of the correlation coefficient. Arbitrarily setting 18% as the minimum amount of variance accounted for to be considered practical significance, only those schools having sample sizes greater than or equal to 20 were included in the reporting of median correlations. Therefore, in certain cases, the median correlation coefficients reported were based on less than 21 schools, such as in the case of the BAB Clerical and Chemistry correlation. Thus, the median correlations are reported as well as the range of correlation coefficient and the number of schools for which the median score was based.

For the total sample, the overall correlation between each BAB test and each of the ten academic criteria was computed. The overall validity score is not the mean correlation of the 21 schools obtained by averaging correla-

tions but rather the correlation of criteria and BAB test based on the entire sample after standardization to a common z-scale had been made for each of the 21 schools.

The intercorrelation matrix of the BAB tests is presented along with a series of stepwise multiple regression analyses. The four separate regression analysis were performed in which the dependent variables - grade point average, English, Math, and Science Average and the independent variables were a subset of the following BAB tests: Vocabulary, Clerical, Ideaphoria, Paper Folding, Analytical Reasoning and Idea Fluency.

To ascertain differential validity, the correlation between each BAB test and the grade point average was computed for males, females, Blacks, Whites, and Hispanics. Later, each correlation coefficient for each group was converted to Fisher's Z_r value and tested to determine if it was significantly different from zero. Finally, to determine differential validity, comparisons in correlation coefficients were made to see if significant differences existed between males and females, Blacks and Whites, Blacks and Hispanics, and Hispanics and Whites.

To determine the construct validity of the BAB, the BAB tests were correlated with the Differential Aptitude Tests and the American College Tests. The intercorrelation matrices for the DAT and ACT were computed and presented for comparative purposes with a similar one for the BAB. Finally, the validity coefficients of the ACT with each of the ten academic criteria was made to examine its effectiveness of prediction in comparison to the BAB.

RESULTS

Derivation of Socio-Economic Status Index

Preliminary factor analyses were performed on subsets of the following SES variables: mother's and father's educational and occupational level, parents' income as reported by the student and by his parents, and number of household items in the home. Occupational level for each parent was derived using two methods. One method employed the occupational classification scheme used by Reiss (1965), specifically the population decile scale score derived from Reiss's socio-economic index where 10 equaled the highest SES and 1 equaled the lowest. The second method used was Roe's (1964) occupational classification by level of function. For ease of interpreting results, Roe's original six point scale was reversed so that the first level represented unskilled laborers and the sixth level represented professional and managerial workers. The complete results of the preliminary factor analyses are not reported here. However correlations between mother and father's occupational level were .39 using Roe's method and .35 using Reiss's method. Meanwhile, the correlation between the Reiss and Roe's occupational scales were .78 for mothers and .82 for fathers. The educational level of mothers and fathers correlated .18. Interestingly, when parent's and student's estimates for parental income were correlated, a .64 coefficient resulted with the parents reporting a lower mean income than their children reported them as having.

The final factor analysis was performed by using the above mentioned variables in which simple structure was best achieved resulting in simple factor structure. Table 4 presents the intercorrelation of the four SES variables included in the final factor analyses, Father's occupation was measured according to Roe's classification and parental income was based on the response of the parents. Parents' Income correlated .64 with Father's occupational level and .56 with his educational level. All of the reported correlation coefficients are significant at the .01 level. The lowest correlations are reported when the number of household items in the home is matched with the other three SES measures.

Insert Table 4 about here

Factor Analyses of the four SES variables yielded one factor which explains 50.3 percent of the total variance as is shown in Table 5. The factor loading was greatest for Father's occupational level (.85) followed by Father's education (.76), Parent's Income (.76) and number of items in the home (.46). This pattern of loading can best be described as socio-economic status factor.

Insert Table 5 about here

Level Differences in Predictor Performance

The results of the seventeen 3 (SES) X 2 (Sex) x 2 (Location) X 3 (Ethnic Group) between-group Analyses of Variances are summarized in Table 6 for the BAB tests. Significant SES, Sex, and Ethnic group differences are found in the performance on the following BAB tests: Pitch, Paper Folding, Vocabu-

lary, Ideaphoria, Shape Assembly, and Analytical Reasoning. Significant SES differences are found on all tests except Rhythm, Finger Dexterity, and Grip. Sex differences are significant for all tests except Idea Fluency, Tonal Memory, Rhythm, Inductive Reasoning, and Finger Dexterity-Left. Significant Ethnic group differences exist on all tests but Clerical, Rhythm, Word Association, Writing Speed, and Finger Dexterity-Left. Significant Location differences exist only for Idea Fluency, Ideaphoria, Finger Dexterity-Right and Grip-Right.

Two-way interaction effects occur with Clerical, Writing Speed, Ideaphoria, Finger Dexterity-Left and Grip-Left. The most frequent two-way significant interactions occur with the SES X RACE and SEX X RACE.

Three-way and four-way interactions are significant for Word Association, Writing Speed, and Ideaphoria.

Insert Table 6 about here

The results of the 3 (SES) X 2 (Sex) X 2 (Location) X 3 (Ethnic) between group analyses of variance for each of the ten academic criteria are presented in Table 7. No significant Location effects are found. Significant SES effects exist for performance in English, Economics, Physics, and Social Studies. Significant Sex differences are found for all criteria except Chemistry. Ethnic group differences are significant for all but English and Chemistry.

Two-way interaction effects are significant for all criteria except Economics and Social Studies. SES X Location and Sex X Location are the two-way

interactions found to be significant more frequently among the ten criteria than the other two-way interactions.

A significant three-way interaction exists only for Social Studies. No significant four-way interactions are found.

Insert Table 7 about here

A detailed summary of sex and ethnic group means and standard deviations for each of the BAB tests are shown in the Appendix and in Tables A to Q.

Concurrent Validation: Academic Criteria

The median validity coefficients for each BAB test with each of the academic criterion are shown in Table 8. Since adequate sample sizes could not be achieved for some criteria in certain schools, the number of schools for which the median coefficient is based is reported. In particular, few schools had adequate sample sizes for the computation of the correlation coefficient with the Chemistry criterion.

Of the ten criteria, generally the GPA criterion had the highest correlation with each BAB test. If we adopt a correlation coefficient of .30 as significant in determining whether a test is valid or not, then the valid tests for each of the ten criteria are listed below followed by its validity coefficient:

(a) GPA

- V (.48), IP (.40), PF (.35), C (.35), IF (.34), AR (.33)

- (b) English
 - V (.45), AR (.36), IP (.35), IF (.33), C (.30)
- (c) Math
 - AR (.33), PF (.32)
- (d) Economics
 - IP (.35), IP (.34), V (.34)
- (e) Biology
 - V (.46), IF (.30)
- (f) Physics
 - V (.44), AR (.34), C (.30)
- (g) Chemistry
 - AR (.49), V (.42), PF (.33)
- (h) Science Average
 - V (.44), AR (.40), PF (.36), C (.31)
- (i) Social Studies
 - V (.44), IP (.35), AR (.33)
- (j) Foreign Languages
 - V (.28), IP (.26)

When used the same criterion of significance (.30), no test is valid for Foreign Language. The Vocabulary and Analytical Reasoning tests are valid for most of the ten criteria. The following tests are not valid for any of the ten academic criteria: Tonal Memory, Pitch, Rhythm, Inductive Reasoning, Word Association, Writing Speed, Finger Dexterity, Grip, and Shape Assembly.

Insert Table 8 about here

Table 9 shows the validity coefficients and their corresponding test of statistical significance for the total sample. Since the criterion measures were standardized (by Z transformations) across schools, statistically significant values obtained by the correlation between test and criterion are indications that the tests are valid.

As seen in Table 9, significant validity coefficients for all ten criteria are obtained for the Vocabulary, Clerical, Idea Fluency, Paper Folding, Ideaphoria, and Analytical Reasoning tests. Rhythm and Finger Dexterity-Right are valid for none of these ten criteria. The four best predictors and their corresponding correlations (all significant at the .01 level) for each of the ten academic criteria are as follows:

(a) English

- V (.39), IP (.30), AR (.28), C (.26)

(b) Math

- AR, (.25), V (.23), PF (.23), IP (.19)

(c) Economics

- V (.36), IP (.28), AR (.28), IF (.24)

(d) Biology

- V (.39), AR (.25), PF (.22), IF (.21), C (.21)

(e) Physics

- V (.32), AR (.26), C (.25), PF (.24)

(f) Chemistry

- V (.26), PF (.26), WS (.25), IP (.23)

(g) Science Average

- V (.37), AR (.29), C (.27), PF (.24)

(h) Social Studies

- V (.39), IP (.28), AR (.27), C (.26)

(i) Foreign Languages

- V (.25), IP (.24), Grip-L (-.24), Grip-R (-.23)

(j) GPA

- V (.43), IP (.33), AR (.33), C (.30)

The Vocabulary test is the single best predictor for all criteria except Math where it is the second best predictor. The Grip test negatively correlates with performance in foreign languages.

Insert Table 9 about here

As a preliminary step of the computation of the series of regression analyses the intercorrelation matrix for the BAB was computed. The BAB intercorrelation matrix is presented in Table 10. It is noted that the intercorrelations obtained among tests were very low. The highest correlations are: Vocabulary-Analytical Reasoning (.55), Pitch-Tonal Memory (.58), Rhythm-Tonal Memory (.52), Inductive Reasoning-Rhythm (.62), Writing Speed-Rhythm (.63), Paper Folding-Rhythm (.52), Ideaphoria-Idea Fluency (.51), Finger Dexterity Left and Right (.49), Grip Left and Right (.91), and Shape Assembly and Paper Folding (.49).

Insert Table 10 about here

The result of stepwise multiple regression analysis revealed a multiple R of .536 when predicting GPA (Table 11) from the Vocabulary, Clerical, Ideaphoria, and Paper Folding tests. Similarly, the linear combination of Vocabulary, Ideaphoria, and Clerical tests yield a multiple correlation of .483 in predicting English (Table 12). A multiple R of .328 is found when Math grade is the criterion variable and Vocabulary, Idea Fluency, and Clerical tests are predictor variables (Table 13). Finally, Table 14 presents the results of the regression analysis with Science Average as the criterion variable and Vocabulary, Clerical, and Paper Folding are the predictor variables. The multiple correlation obtained is .437 when Science Average is the criterion variable. All four multiple R coefficients are significant at the .01 level.

Insert Table 11 about here

Insert Table 12 about here

Insert Table 13 about here

Insert Table 14 about here

Differential Validity

As an effort of examining differential validity of the BAB, each BAB test is correlated with the grade point average across sex and ethnic group

and is presented in Table 15. Significant correlation coefficients are obtained across all sex and ethnic groups for the following BAB tests: Clerical, Idea Fluency, Writing Speed, Paper Folding, Vocabulary, Ideaphoria, and Analytical Reasoning. When the same GPA is used as a criterion, Inductive Reasoning and Grip-Right are significant for males but not females. Likewise, Tonal Memory and Pitch Discrimination are significant for females but not males. Concerning differential validity among ethnic groups, the Shape Assembly test is significant only for the White ethnic group. Tonal Memory and Word Association are significant for Blacks and Hispanics but not for Whites. Writing Speed is significant for Blacks and Whites but not Hispanics. The Rhythm test is not significant for any sex or ethnic group.

Insert Table 15 about here

It is suggested from these results that separate validity coefficients for each sex and ethnic group appear to be useful for making separate predictions of academic performance for each individual group. However, to determine if a set of tests are more effective in predicting academic performance for one group as opposed to another, Fisher's Z test results are presented in Table 16 which compare the correlation coefficients between BAB tests and GPA for sex groups and various combinations of ethnic groups. No significant differences were found between the validity coefficients obtained from males and females. Black-White differences in validity were found for Word Association, Shape Assembly, and Writing Speed. Black-Hispanic differences are reported for Word Association, Finger Dexterity-Right, and Shape Assembly.

No significant differences exist for any sex or ethnic group comparison for the validity of Clerical, Idea Fluency, Tonal Memory, Pitch, Rhythm, Inductive Reasoning, Vocabulary, Ideaphoria, Finger Dexterity-Left, Grip Left and Right, and Analytical Reasoning tests.

Insert Table 16 about here

In Tables R through V of the Appendix, the validity coefficients for each sex and ethnic group is presented across the ten academic criteria. The Vocabulary test significantly correlates with all ten academic criteria for all sex and ethnic groups (except for Chemistry grades for Hispanics).

Construct Validity of the BAB

As a preliminary step to ascertaining the construct validity of the BAB relative to the DAT, the intercorrelation matrix of the DAT is computed and presented in Table 17. It is noted that there exist relatively high intercorrelations among the DAT subtests. The highest correlation is reported between Verbal Reasoning and Numerical Ability (.77) and between Spelling and Language Usage (.77).

Insert Table 17 about here

Evidence of construct validity is obtained from the correlations between the BAB and DAT tests as shown in Table 18. The DAT tests which have the highest statistically significant correlations with each subtest of BAB are presented below, followed by the respective correlation coefficient in parenthesis:

- (a) BAB Clerical--Spelling, (.50), Verbal Reasoning (.31)
- (b) BAB Idea Fluency--Verbal Reasoning (.34), Abstract Reasoning (.23)
- (c) BAB Inductive Reasoning--Abstract Reasoning (.42), Mechanical Reasoning (.39), Spatial Reasoning (.37)
- (d) BAB Word Association--Verbal Reasoning (.22)
- (e) BAB Writing Speed--Clerical (.30), Abstract Reasoning (.27)
- (f) BAB Paper Folding--Spatial Reasoning (.60), Verbal Reasoning (.59)
Abstract Reasoning (.56), Mechanical Reasoning (.56), Numerical Ability (.56)
- (g) BAB Vocabulary--Verbal Reasoning (.73), Language Usage (.59)
- (h) BAB Ideaphoria--Abstract Reasoning (.22), Verbal Reasoning (.21)
- (i) BAB Finger Dexterity-Left--Abstract Reasoning (.19)
- (j) BAB Finger Dexterity-Right--Numerical Ability (.19)
- (k) BAB Grip-Left--Mechanical Reasoning (.48), Abstract Reasoning (.27)
- (l) BAB Grip-Right--Mechanical Reasoning (.49), Abstract Reasoning (.24)
- (m) BAB Shape Assembly--Mechanical Reasoning (.61), Numerical Ability (.55), Spatial Reasoning (.47)
- (n) BAB Analytical Reasoning--Verbal Reasoning (.64), Numerical Ability (.56), Mechanical Reasoning (.53)

Insert Table 18 about here

Prior to the examination of construct validity between BAB and ACT, the intercorrelation of ACT is computed and presented in Table 19. The five sub-

tests included in the ACT are highly intercorrelated, with coefficients ranging from .44 to .84. The lowest correlation obtained is between The English Subtest and The Composite Score, the highest correlation is between the Natural Science and Social Studies subtests.

Insert Table 19 about here

Although strictly speaking the ACT is a collection of achievement tests, its correlation with the BAB provides support for construct validity of the BAB. The correlation coefficients between the ACT and the BAB tests are presented in Table 20. The Writing Speed, Finger Dexterity-Left and Right, and Grip-Left and Right tests of BAB do not significantly correlate with any of the ACT tests. The BAB tests having the highest significant correlations with the ACT tests are as follows, followed by the correlation coefficient in parenthesis:

- (a) ACT English - Pitch (.68), Vocabulary (.65), Analytical Reasoning (.62)
- (b) ACT Math - Paper Folding (.61), Vocabulary (.60), and Analytical Reasoning (.57).
- (c) ACT Social Science - Vocabulary (.73), Analytical Reasoning (.67), and Paper Folding (.54)
- (d) ACT Health Science - Analytical Reasoning (.66), Vocabulary (.66), and Paper Folding (.61)
- (e) ACT Comprehensive - Analytical Reasoning (.57), Pitch (.54), and Tonal Memory (.52)

Insert Table 20 about here

For comparative purposes, the concurrent validity of the ACT against the ten academic criteria is presented in Table 21. Each of the ACT tests significantly correlate with GPA; the correlation coefficients ranging from .29 to .35, the highest being with ACT composite score. The ACT English test correlates .06 with English grades but .30 with grades in Physics and .29 with Social Studies grades. ACT Math test correlates .22 with Math grades, but .31 with grades in Foreign Languages, Social Studies, and Chemistry. ACT Social Studies test correlates .30 with Social Studies grades, .24 with Biology and Foreign Language grades. ACT Natural Science test correlates .30 with Biology grades but .19 with Physics and Chemistry grades and .30 with grades obtained in Social Studies. ACT Composite scores correlate .41 with grades in Biology, .39 with Economic grades, and .35 with GPA.

Insert Table 21 about here

DISCUSSION

Derivation of SES Index

The empirically derived SES factor accounts for 50.3 percent of the total variance of the four SES variables. The father's occupational level contributes most to explaining variance of the SES factor, followed closely by the father's educational level and parents combined income. The number of household items in the home contributes least to account for the explained variance of the SES factor. From this result, it is clear that the socio-economic status of an individual is not something simply gauged by income or the collection of material objects but is strongly related to one's occupational level and educational attainment achieved.

Level Difference in Aptitude and Criterion Performance

With regard to performance on the BAB, there are few tests with regional differences implying a relatively homogeneous distribution of aptitudes across locations. Most of level differences due to sex and race were evident on the Verbal and Reasoning tests. All tests except for Grip and Finger Dexterity show SES differences in performance. These results clearly indicate that environmental exposure and stimulation seem to least likely affect psychomotor aptitudes. On the non-psychomotor aptitudes, however, the SES effect is more salient than those attributed to race or sex indicating the possibility that "opportunity" is a variable contributing to level differences than genetic endowment. Furthermore, for the most part interaction

between SES and Sex as well as SES and Race did not reach the level of significance.

The key issue of the present study is not to examine whether or not level differences exist but rather the existence of differential validity. Level differences may exist for specific aptitudes but if the specific aptitude is not as important (i.e. valid) to one group as it is to another the resulting level differences are not as meaningful. Thus it is no use speculating about level difference if:

- (a) level differences exist on an aptitude not valid for an intended purpose (e.g. the predication of performance); and
- (b) the different groups have differential validity (i.e. the aptitude may be predictive for one group but not another).

Concerning group differences on the academic criteria, Guion (1974) has called attention to this neglected aspect of test construction; "understanding criteria is every bit as important as understanding tests". In performing criterion-related validity studies, one should examine not only potential bias in the tests but also in the criterion itself. When considering the existence of unequal cell sizes, its impact should be taken into consideration in interpreting the results of analysis of variance.

Sex and ethnic group differences exist for practically all of the ten academic criteria. No differences existed between the Illinois and Texas sample. SES differences exist only for the English, Economics, and Social Studies criteria implying that courses with a higher verbal content possibly are influenced more by the opportunity to learn and enrich English vocabulary.

Concurrent Validation: Academic Criteria

BAB validity coefficients are in general highest for GPA and lowest for courses in foreign languages. The GPA measure is a composite index over a longer period, a relatively stable measure and thus resulting in higher coefficients. The foreign language criterion is somewhat ambiguous since any non-English language course grades were used. Furthermore, the large Hispanic sample complicated the interpretation of this criterion, since performance in the course for some were related to learning a second language as opposed to the first.

The BAB music and psychomotor tests are not predictive of academic success for the ten criteria. It should be further examined why Inductive Reasoning and Shape Assembly are also not valid in predicting academic success.

Significant validity coefficients for all ten academic criteria are obtained by the Vocabulary, Clerical, Idea Fluency, Paper Folding, Ideaphoria, and Analytical Reasoning tests. Likewise, multiple regression analysis indicates that criterion measures can more than adequately be predicted from the above combination of tests.

Differential Validity

Significant validity coefficients are obtained across all sex and ethnic groups for the following BAB tests: Clerical, Idea Fluency, Writing Speed, Paper Folding, Vocabulary, Ideaphoria, and Analytical Reasoning - providing clear evidence as to the importance of these aptitudes for academic success.

Likewise, it is assuring to note that validity coefficients obtained for males and females are not significantly different. Differential validity is obtained for only a few BAB tests relative to ethnic group comparisons. The tests shown differential validities relative to certain ethnic group comparisons (i.e. Shape Assembly, Tonal Memory, Word Association, Writing Speed, and Finger Dexterity - Right) are generally not predictive of academic success for the study sample.

Construct Validity of the BAB

The patterns of intercorrelation, among the BAB and DAT tests are indicative that adequate construct validity exists. BAB Paper Folding, Shape Assembly, Inductive Reasoning, and Analytical Reasoning tests correlate highly with the DAT's Abstract Reasoning, Verbal Reasoning, Spatial Reasoning, and Mechanical Reasoning tests. BAB Clerical test and DAT Spelling test as well as BAB's Writing Speed test and DAT Clerical test have relatively high correlations. BAB Inductive Reasoning, Word Association, and Vocabulary showed the highest correlation with DAT Verbal Reasoning test. BAB Grip test correlated highest with DAT Mechanical Reasoning test but BAB Finger Dexterity tests do not have an adequate DAT counterpart.

On the other hand, BAB Vocabulary test and ACT English test correlate highly, ACT Math test and BAB Paper Folding, Vocabulary, and Analytical Reasoning tests correlate substantially as well. ACT Math test has a strong verbal component as the ACT Math-BAB Vocabulary correlation further indicates. In fact, all ACT tests have a larger verbal component and correlates rather highly with the BAB Vocabulary test.

Since the ACT is somewhat an achievement test rather than strictly aptitudinal in nature, comparisons of correlations between the BAB and ACT may not provide an adequate basis for determining construct validity. A more relevant aspect is the criterion-related validity of the ACT as compared to the BAB. The ACT composite score, as well as the other ACT scores, are good predictors of GPA. However, the ACT tests do not differentially predict the other ten academic areas as well. The ACT English test correlates .06 with English grades but .30 with Physics grades. Likewise, as reported, the other ACT tests do not do as well as expected in predicting the course grades they are supposed to measure as well as they do in predicting the course grades of subjects they do not measure. The BAB tests do provide the differential prediction as previously mentioned. Multiple regression analysis demonstrates the BAB's effectiveness in predicting course grades, primarily because of the low intercorrelations among subtests. The intercorrelation of the ACT is quite high as reported in the Seventh Measurement Yearbook: "In general, these (ACT) interrelationships are high, tending to confirm the observation that the ACT contains a redundancy of similar intellectual exercises all dependent to some degree on reading composition. A more telling indication of this condition is the fact that there is extremely little incremental validity gained by the addition of more of the parts of the ACT after the first test in a multiple correlation pattern".

TABLE 1

SUMMARY CHARACTERISTICS OF THE BALL APTITUDE BATTERY TESTS

BAB TEST	No. of Items	Scoring Instruction	Maximum Score Possible
Clerical	240	# correct responses	240
Idea Fluency	4	Summation of the # of ideas generated per item	91**
Tonal Memory	30	# correct responses	30
Pitch Discrimination	35	# correct responses	35
Rhythm	30	# correct responses	30
Inductive Reasoning	30	# correct responses	30
Word Association	100*	# of objective responses	54
Writing Speed	N/A	# of letters written in one minute	332**
Paper Folding	24	# correct responses	24
Vocabulary	80	# correct responses	80
Ideaphoria	N/A	total number of words written in 10 minutes	527**
Finger Dexterity	N/A	# of holes filled in with 3 pins	98L 81R
Grip	N/A	total # of kg. pressure over 3 trials	209L 224R
Shape Assembly	6	Depending on speed of completion, each item is assigned 0-5 points total = sum of item scores	30
Analytical Reasoning	18	Depending on speed of completion, each is assigned 0-5 points Total = sum of item scores	80

N/A - not appropriate - no specified number of items

**only 54 items maximum score, highest score obtained by the longitudinal sample

TABLE 2

DISTRIBUTION OF SUBJECTS BY SEX, RACE, SOCIO-ECONOMIC STATUS, AND LOCATION

Sex	Race	SES	Location		Total
			Illinois	Texas	
Male	Black	Lower	27	27	54
		Middle	8	22	30
		Upper	7	12	19
	Hispanic	Lower	12	18	30
		Middle	13	21	34
		Upper	5	10	15
	White	Lower	43	8	51
		Middle	46	21	67
		Upper	58	57	115
	Other	Lower	4	5	9
		Middle	0	0	0
		Upper	1	1	2
Female	Black	Lower	24	45	69
		Middle	21	43	54
		Upper	13	19	32
	Hispanic	Lower	18	30	48
		Middle	9	22	31
		Upper	3	10	13
	White	Lower	36	16	52
		Middle	73	31	104
		Upper	78	49	127
	Other	Lower	3	4	7
		Middle	0	0	0
		Upper	1	2	3
TOTAL			503	493	996

TABLE 3

DISTRIBUTION OF EXPERIMENTAL SAMPLE BY SEX, RACE, AND LOCATION

Sex	Race	Location		Total
		Illinois	Texas	
Male	Black	40	56	96
	Hispanic	24	43	67
	White	96	75	171
	Other	3	7	10
Female	Black	54	106	160
	Hispanic	25	60	85
	White	131	76	207
	Other	2	3	5
TOTAL		375	426	801

TABLE 4

INTERCORRELATION OF SOCIO-ECONOMIC STATUS VARIABLES

SES Variable	Father's Occupation	Parents' Income	# of items in home	Father's Education
Father's Occupation	---			
Parents' Income	.64	---		
# of items in home	.36	.38	---	
Father's Education	.67	.56	.34	---

TABLE 5

FACTOR MATRIX USING PRINCIPAL FACTOR WITH 9 ITERATIONS

Variable	Factor 1	Communality
Father's Occupation	.85095	.72412
Parents' Income	.75596	.57148
# of items in home	.45599	.20792
Father's Education	.76102	.57916
Eigenvalue		2.08268
% of total variance		50.3

TABLE 6

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PROBABILITIES ASSOCIATED WITH SIGNIFICANCE TEST FOR
4-WAY ANALYSIS OF VARIANCE, WITH SOCIO-ECONOMIC
STATUS, SEX, LOCATION, AND RACE AS INDEPENDENT VARIABLES
AND BAB TESTS AS DEPENDENT VARIABLES

BAB TEST	MAIN EFFECTS					INTERACTION EFFECTS								
	Joint	SES	Sex	Location	Race	SES-X Sex	SES-X Location	SES-X Race	Sex X Location	Sex X Race	Location X Race	Joint 2 way	Joint 3 way	Joint 4 way
Clerical	001	001	001	058	551	065	039	001	538	957	039	001	119	208
Idea Fluency	001	001	080	001	001	677	674	301	869	624	011	167	280	161
Tonal Memory	001	005	632	093	001	992	784	545	640	711	141	589	974	629
Pitch	001	001	022	541	001	573	361	048	175	326	325	331	697	212
Rhythm	117	056	336	492	376	625	967	368	885	914	304	856	678	731
Inductive Reasoning	001	002	472	995	001	885	546	099	015	146	431	146	124	449
Word Assoc.	001	012	001	729	114	890	620	868	436	279	077	643	034	001
Writing Speed	001	001	003	377	339	030	214	001	170	917	454	003	001	045
Paper Folding	001	001	001	557	001	651	241	183	413	728	353	173	036	248
Vocabulary	001	001	030	299	001	932	065	034	436	918	748	073	156	060
Ideaphoria	001	001	001	001	001	650	003	055	838	004	254	001	008	042
F.D. Left	076	134	066	194	238	517	669	611	875	003	172	042	815	792
F.D. Right	001	143	001	014	024	427	404	110	385	119	215	071	755	232
Grip Left	001	299	001	004	001	751	246	180	700	001	715	024	452	733
Grip Right	001	106	001	001	001	693	602	377	630	008	720	248	633	908
Shape Assembly	001	001	001	266	001	766	719	356	108	074	520	519	908	664
Analytical Reasoning	001	001	008	013	001	988	271	050	748	990	508	462	244	217

*Decimal points are omitted.

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TABLE 7

PROBABILITIES ASSOCIATED WITH SIGNIFICANCE TESTS FOR
4-WAY ANALYSIS OF VARIANCE, WITH SOCIO-ECONOMIC
STATUS, SEX, LOCATION AND RACE AS INDEPENDENT VARIABLES
AND ACADEMIC COURSE GRADES AS DEPENDENT VARIABLES

COURSE GRADE	MAIN EFFECTS					INTERACTION EFFECTS								
	Joint	SES	Sex	Region	Race	SES-X Sex	SES-X Region	SES-X Race	Sex X Region	Sex X Race	Region X Race	Joint 2 way	Joint 3 way	Joint 4 way
English	001	027	001	535	162	514	047	660	001	461	174	002	536	207
Math	001	691	001	562	045	954	017	334	041	800	253	042	320	114
Economics	001	033	001	226	016	682	768	653	035	458	194	200	882	626
Biology	001	179	001	342	017	471	016	425	037	072	101	001	652	642
Physics	001	037	012	502	092	441	198	594	137	046	252	038	693	051
Chemistry	460	853	115	487	206	594	313	039	008	550	121	011	639	826
ScienceAve	001	099	001	390	043	749	001	202	243	018	173	001	831	668
Soc. Study	001	027	001	352	027	532	029	938	047	526	529	167	028	559
Foreign Language	001	292	001	692	001	456	232	168	004	083	448	004	802	064
GPA	001	118	001	410	028	372	032	490	106	380	014	001	090	284

^a Decimal points are omitted.

TABLE 8

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MEDIAN VALIDITY COEFFICIENTS FOR EACH BAB TEST AGAINST EACH OF THE ACADEMIC CRITERIA

BAB TEST	ENGLISH	MATH	ECONOMIC	BIOLOGY	PHYSICS	CHEM	SCI AVE	SOC STU	FOR LANG	GPA	STATISTIC
Clerical	.30	.21	.18	.22	.30	.19	.31	.24	.13	.35	Median Corr.
	-.14 to .56	-.08 to .58	-.34 to .53	-.02 to .57	.06 to .64	.15 to .23	-.01 to .51	-.22 to .60	-.05 to .74	-.08 to .69	Range
	21	20	16	17	12	2	17	20	11	18	# of Schools
Idea Fluency	.33	.17	.34	.30	.21	.18	.24	.27	.18	.34	Median Corr.
	-.06 to .64	-.14 to .40	-.21 to .49	-.00 to .50	.04 to .53	.08 to .27	-.01 to .61	-.23 to .51	.04 to .52	.02 to .70	Range
	21	20	14	17	12	2	17	20	10	18	# of Schools
Tonal Memory	.07	.07	.13	.06	.20	.02	-.01	.13	.09	.27	Median Corr.
	-.14 to .36	-.20 to .36	-.14 to .46	-.05 to .50	-.13 to .40	.02 to .02	-.14 to .29	-.13 to .26	-.19 to .18	-.14 to .41	Range
	7	7	5	7	4	1	7	7	5	7	# of Schools
Pitch	.10	.07	.17	.21	.18	.14	.13	.08	.16	.24	Median Corr.
	-.07 to .36	-.17 to .35	-.05 to .35	-.09 to .49	-.04 to .36	-.04 to .32	-.14 to .50	-.01 to .33	.01 to .21	.01 to .49	Range
	7	7	5	7	4	2	7	7	5	7	# of Schools
Rhythm	.16	.02	.07	.05	.19	.13	.09	-.04	.21	.16	Median Corr.
	-.20 to .33	-.06 to .35	-.05 to .19	-.33 to .41	-.03 to .79	-.13 to .13	-.16 to .22	-.22 to .42	-.18 to .42	-.28 to .27	Range
	7	7	5	7	6	1	7	7	5	7	# of Schools

TABLE 8 - (Cont.)
 MEDIAN VALIDITY COEFFICIENTS FOR EACH BAB TEST AGAINST EACH OF THE ACADEMIC CRITERIA

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BAB TEST	ENGLISH	MATH	ECONOMIC	BIOLOGY	PHYSICS	CHEM	SCI AVE	SOC STU	FOR LANG	GPA	STATISTIC
Inductive Reasoning	.18	.14	.20	.10	.22	-.04	.17	.13	.06	.15	Median Corr.
	-.10 to .39	-.15 to .37	-.14 to .64	-.14 to .42	-.09 to .49	-.05 to .19	-.18 to .48	-.23 to .56	-.06 to .51	-.15 to .59	Range
	21	19	14	16	12	3	17	20	11	18	# of Schools
Word Assoc.	.10	.11	.09	-.06	.07	-.13	-.02	.05	.07	.02	Median Corr.
	-.37 to .34	-.20 to .50	-.18 to .25	-.30 to .48	-.42 to .31	-.29 to .01	-.27 to .38	-.31 to .45	-.39 to .29	-.35 to .44	Range
	21	20	14	17	17	2	17	20	11	18	# of Schools
Writing Speed	.22	.20	.23	.10	.04	.03	.11	.21	.18	.23	Median Corr.
	-.43 to .57	-.37 to .45	-.32 to .50	-.13 to .67	-.04 to .73	-.37 to .53	-.14 to .72	-.29 to .74	-.07 to .29	-.23 to .78	Range
	20	20	14	18	11	3	17	20	10	18	# of Schools
Paper Folding	.27	.25	.32	.27	.25	.33	.36	.17	.23	.35	Median Corr.
	-.43 to .55	-.19 to .58	-.41 to .62	.00 to .49	.07 to .44	-.08 to .41	-.06 to .52	-.29 to .64	-.09 to .58	.10 to .54	Range
	21	20	17	19	12	5	17	20	11	17	# of Schools
Vocabulary	.45	.24	.34	.46	.44	.42	.44	.44	.28	.48	Median Corr.
	.17 to .69	-.16 to .59	.20 to .67	.20 to .65	-.02 to .65	.32 to .54	-.01 to .69	.03 to .74	-.17 to .52	.08 to .75	Range
	21	21	15	18	12	3	17	20	11	18	# of Schools
Ideas-Phoria	.35	.21	.35	.24	.18	.19	.26	.35	.26	.40	Median Corr.
	-.07 to .65	-.12 to .44	-.08 to .69	-.22 to .68	-.33 to .79	.12 to .26	-.25 to .72	-.17 to .63	.05 to .56	-.13 to .72	Range
	21	20	14	17	12	2	17	20	12	18	# of Schools

TABLE 8 - (Cont.)

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MEDIAN VALIDITY COEFFICIENTS FOR EACH BAB TEST AGAINST EACH OF THE ACADEMIC CRITERIA

BAB TEST	ENGLISH	MATH	ECONOMIC	BIOLOGY	PHYSICS	CHEM	SCI AVE	SOC STU	FOR LANG	GPA	STATISTIC
F.D. Left	.04	.03	.04	.00	.11	.14	.07	.02	.13	.08	Median Corr.
	-.40 to .47	-.32 to .36	-.25 to .20	-.36 to .51	-.19 to .52	.04 to .24	-.30 to .52	-.28 to .57	-.34 to .27	-.16 to .44	Range
	20	19	15	17	12	3	18	20	13	18	# of Schools
F.D. Right	-.03	.09	.00	-.01	.01	-.09	.01	.02	.01	.19	Median Corr.
	-.29 to .26	-.36 to .38	-.39 to .39	-.41 to .32	-.42 to .36	-.17 to .22	-.43 to .29	-.54 to .34	-.31 to .34	-.44 to .38	Range
	20	19	14	17	12	4	17	20	13	18	# of Schools
Grip Left	-.26	-.20	-.28	-.20	-.09	-.08	-.19	-.07	-.26	-.25	Median Corr.
	-.54 to .18	-.57 to .35	-.40 to .39	-.50 to .39	-.23 to .22	-.11 to -.04	-.29 to .43	-.43 to .17	-.48 to .32	-.53 to .49	Range
	18	17	11	15	9	2	15	17	8	14	# of Schools
Grip Right	-.20	-.20	-.27	-.19	-.05	-.04	-.11	-.06	-.24	-.24	Median Corr.
	-.54 to .33	-.56 to .35	-.45 to .34	-.33 to .46	-.28 to .32	-.10 to .03	-.31 to .51	-.49 to .16	-.49 to .17	-.53 to .17	Range
	19	18	12	15	10	2	15	18	10	15	# of Schools
Shape Assembly	-.01	.07	.10	.05	.14	.10	.11	.06	.08	.07	Median Corr.
	-.24 to .29	-.35 to .54	-.35 to .49	-.28 to .26	-.14 to .39	-.03 to .32	-.08 to .30	-.21 to .25	-.09 to .30	-.28 to .43	Range
	19	19	13	16	12	3	16	18	10	16	# of Schools
Analytic. Reasoning	.36	.33	.29	.22	.34	.49	.40	.33	.22	.33	Median Corr.
	-.19 to .75	-.18 to .66	-.09 to .68	-.09 to .53	-.06 to .57	.48 to .50	-.17 to .63	-.34 to .70	.10 to .53	-.17 to .64	Range
	20	19	14	17	11	2	18	19	9	17	# of Schools

TABLE 9

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VALIDITY COEFFICIENTS FOR EXPERIMENTAL SAMPLE^a

BAB TEST	ENGLISH	MATH	ECONOMIC	BIOLOGY	PHYSICS	CHEM	SCI AVE	SOC STU	FOR LANG	GPA
Clerical	.26 (640) **	.18 (639) **	.18 (476) **	.21 (583) **	.25 (419) **	.19 (238) **	.27 (594) **	.26 (630) **	.16 (421) **	.30 (574) **
Idea Fluency	.25 (640) **	.16 (639) **	.24 (476) **	.21 (583) **	.19 (418) **	.14 (240) *	.20 (594) **	.22 (630) **	.15 (423) **	.28 (574) **
Tonal Memory	.06 (221)	.09 (221)	.08 (182)	.12 (213) *	.14 (150) *	.11 (84)	.02 (211)	.03 (220)	.11 (159)	.15 (221) *
Pitch	.11 (220) **	.08 (220)	.13 (181) *	.22 (212) **	.14 (149) *	.01 (83)	.15 (210) *	.07 (219)	.13 (158)	.21 (220) **
Rhythm	.02 (220)	.06 (220)	.01 (181)	.04 (212)	.11 (149)	.15 (83)	.01 (210)	-.07 (219)	.12 (158)	.03 (220)
Inductive Reasoning	.10 (643)	.10 (642) **	.10 (479) *	.07 (585) *	.14 (421) **	.06 (242)	.07 (597) *	.07 (633) *	.12 (425) **	.11 (576) **
Word Assoc.	.05 (643)	.09 (642) *	.07 (478)	.04 (585)	.01 (420)	-.05 (242)	.05 (597)	.06 (633)	-.01 (424)	.06 (576)
Writing Speed	.05 (624)	.04 (623)	.07 (469)	.10 (570) **	.06 (410)	.25 (239) **	.07 (581) *	.05 (614)	.14 (412) **	.15 (559) **
Paper Folding	.18 (643) **	.23 (642) **	.20 (478) **	.22 (585) **	.24 (420) **	.26 (241) **	.24 (597) **	.19 (633) **	.21 (425) **	.27 (576) **
Vocab.	.39 (642) **	.23 (641) **	.36 (477) **	.39 (584) **	.32 (419) **	.26 (241) **	.37 (596) **	.39 (632) **	.25 (424) **	.43 (575) **
Idea- phoria	.30 (639) **	.19 (638) **	.28 (474) **	.20 (581) **	.17 (416) **	.23 (239) **	.20 (593) **	.28 (629) **	.24 (423) **	.33 (572) **
F.D. Left	.05 (637)	.03 (636)	.02 (476)	.02 (579)	.10 (417) *	.11 (240) *	.04 (591)	.04 (627)	.08 (420)	.10 (570) **
F.D. Right	-.00 (636)	.03 (635)	-.02 (475)	-.04 (578)	-.03 (416)	.07 (240)	-.03 (590)	-.05 (626)	.05 (420)	-.01 (569)
Grip Left	-.23 (559) **	-.16 (558) **	-.16 (414) **	-.12 (505) **	-.04 (365)	-.06 (211)	-.11 (517) **	-.12 (549) **	-.24 (373) **	-.16 (502) **

TABLE 9 - (Cont.)

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VALIDITY COEFFICIENTS FOR TOTAL EXPERIMENTAL SAMPLE

EAB TEST	ENGLISH	MATH	ECONOMIC	BIOLOGY	PHYSICS	CHEM	SCI AVE	SOC STU	FOR LANG	GPA
Grip Right	-.22 (561) **	-.15 (560) **	-.15 (416) **	-.11 (507) **	-.02 (367)	-.03 (212)	-.07 (519)	-.10 (551) **	-.23 (374) **	-.14 (504) **
Shape Assembly	.03 (587)	.11 (586) **	.07 (430)	.03 (531)	.15 (376) *	.10 (220)	.11 (543) **	.07 (577)	.09 (393) *	.12 (529) **
Ans- lytical Reasoning	.28 (590) **	.25 (589) **	.28 (430) **	.25 (532) **	.26 (378) **	.14 (221) *	.29 (544) **	.27 (580) **	.16 (394) **	.33 (533) **

*The number in parenthesis is the sample size used for the calculation of respective validity.

* $p < .05$

** $p < .01$

TABLE 10
INTERCORRELATION MATRIX FOR THE BALL APTITUDE BATTERY (N=801)

BAB TEST	CLERICAL	IDEA FLUENCY	TONAL MEMORY	PITCH	RHYTHM	INDUCTIVE REASONING	WORD ASSOC.	WRITING SPEED	PAPER FOLDING	VOCABU- LARY	IDEA- PHORIA	F.D. LEFT	F.D. RIGHT	GRIP LEFT	GRIP RIGHT	SHAPE ASSEMBLY	ANALYTICAL REASONING
CLERICAL	--																
IDEA FLUENCY	.11	--															
TONAL MEMORY	.08	.32	--														
PITCH	.02	.38	.58	--													
RHYTHM	-.23	.25	.52	.28	--												
INDUCTIVE REASONING	-.05	.19	.46	.36	.62	--											
WORD ASSOC.	.08	.09	.28	.14	.29	.20	--										
WRITING SPEED	-.02	.20	.40	.23	.63	.31	.13	--									
PAPER FOLDING	-.06	.31	.46	.41	.52	.46	.13	.29	--								
VOCABU- LARY	.21	.42	.27	.42	.14	.23	.09	.11	.45	--							
IDEA- PHORIA	.12	.51	.22	.18	.27	.15	-.01	.29	.35	.36	--						
F.D. LEFT	-.01	.23	.29	.19	.48	.20	.09	.32	.27	.04	.13	--					
F.D. RIGHT	.11	.08	.33	.19	.34	.10	.04	.20	.07	-.13	.08	.49	--				
GRIP LEFT	-.15	.05	.19	-.00	.17	.13	-.06	.08	.18	-.01	-.07	.04	-.02	--			
GRIP RIGHT	-.11	.03	.13	-.05	-.10	.02	-.11	-.02	.15	.00	-.07	-.05	-.04	.91	--		
SHAPE ASSEMBLY	.06	.23	.25	.19	.12	.25	.10	-.01	.49	.30	.12	.11	.09	.27	.28	--	
ANALYTICAL REASONING	.30	.35	.31	.41	.14	.30	.18	.09	.44	.55	.29	.13	.07	-.02	-.00	.41	--

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TABLE 11

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F-RATIO, MULTIPLE R, R^2 , AND SIGNIFICANCE FOR
OVERALL GRADE POINT AVERAGE (GPA)

BAB TEST (Independent variable)	STEP	F To enter or remove	Significance	Multiple R	R Square	Simple r	Overall F	Significance
VOCABULARY	1	117.02	.000	.439	.193	.439	117.02	.000
CLERICAL	2	28.45	.000	.487	.237	.292	76.01	.000
IDEAPHORIA	3	28.15	.000	.528	.279	.360	62.87	.000
PAPER FOLD.	4	5.78	.017	.536	.287	.289	49.06	.000
ANALY. REAS.	5	0.24	.627	.536	.288	.310	39.23	.000
IDEA FLUENCY	6	0.26	.610	.537	.288	.282	32.69	.000

TABLE 12

-43-

F-RATIO, MULTIPLE R, R^2 , AND SIGNIFICANCE FOR
ENGLISH

BAB TEST (Independent variable)	STEP	F To enter or remove	Significance	Multiple R	R Square	Simple r	Overall F	Significance
VOCABULARY	1	103.64	.000	.418	.175	.418	103.64	.000
IDEAPHORIA		19.53	.000	.454	.206	.323	63.55	.000
CLERICAL	3	17.28	.000	.483	.233	.246	49.53	.000
IDEA FLUENCY	4	1.72	.190	.486	.236	.286	37.64	.000
ANALY. REAS.	5	0.18	.667	.486	.236	.297	30.10	.000

TABLE 13

-44-

F-RATIO, MULTIPLE R, R^2 , AND SIGNIFICANCE FOR
MATH

BAB TEST (Independent variable)	STEP	F To enter or remove	Significance	Multiple R	R Square	Simple r	Overall F	Significance
VOCABULARY	1	32.27	.000	.249	.062	.249	32.27	.000
IDEA FLUENCY	2	10.91	.001	.287	.082	.243	21.92	.000
CLERICAL	3	13.96	.000	.328	.108	.171	19.65	.000
IDEAPHORIA	4	2.30	.130	.335	.112	.197	15.35	.000
ANALY. REAS.	5	1.17	.279	.338	.114	.245	12.52	.000

TABLE 14

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F-RATIO, MULTIPLE R, R^2 , AND SIGNIFICANCE FOR
SCIENCE AVERAGE

BAB TEST (Independent variable)	STEP	F To enter or remove	Significance	Multiple R	R Square	Simple r	Overall F	Significance
VOCABULARY	1	84.42	.000	.383	.147	.383	84.42	.000
CLERICAL	2	17.91	.000	.421	.177	.244	52.62	.000
PAPER FOLDING	3	8.12	.005	.437	.191	.247	38.30	.000
IDEAPHORIA	4	2.65	.104	.442	.195	.236	29.48	.000
ANALY. REAS.	5	0.14	.712	.442	.195	.290	25.57	.000

TABLE 15

-46-

CORRELATIONS BETWEEN BAS TESTS AND GRADE POINT AVERAGE FOR
SEX AND ETHNIC GROUPS*

BAS TEST	TOTAL GROUP	MALE	FEMALE	BLACK	WHITE	HISPANIC
Clerical	.3001 (574) ***	.2925 (253) ***	.2648 (321) ***	.3021 (188) ***	.3325 (250) ***	.2267 (121) ***
Idea Fluency	.2846 (574) ***	.2194 (253) ***	.3191 (321) ***	.2550 (189) ***	.2208 (250) ***	.4271 (120) ***
Tonal Memory	.1488 (221) **	.0990 (94)	.1839 (127) *	.3001 (45) *	.0689 (89)	.1972 (76) *
Pitch	.2081 (220) ***	.1008 (94)	.2415 (126) **	.2945 (44) *	.2150 (89) *	.2409 (76) *
Rhythm	.0311 (220)	.0628 (94)	-.0013 (126)	.1894 (44)	.1238 (89)	-.0566 (76)
Inductive Reasoning	.1093 (576) **	.1735 (254) **	.0674 (322)	.0450 (189)	.1638 (251) **	.0883 (121)
Word Assoc.	.0562 (576)	.0570 (255)	-.0038 (321)	.1797 (189) **	-.0880 (251)	.1733 (121) *
Writing Speed	.1477 (559) ***	.1833 (248) **	.1020 (311) *	.2973 (177) ***	.1747 (248) **	.0662 (119)
Paper Folding	.2723 (576) ***	.3397 (254) ***	.2690 (322) ***	.2510 (189) ***	.3249 (251) ***	.1603 (121) *
Vocab.	.4304 (575) ***	.4348 (253) ***	.4257 (322) ***	.3762 (188) ***	.3955 (251) ***	.5250 (121) ***
Ideaphoria	.3263 (572) ***	.3158 (253) ***	.3040 (319) ***	.2519 (185) ***	.3236 (251) ***	.3739 (121) ***
F.D. Left	.0973 (570) **	.0899 (250)	.0881 (320)	.1768 (185) **	.1546 (250) **	-.1492 (120)
F.D. Right	-.0063 (569)	-.1026 (249)	.0402 (320)	.0646 (185)	.0211 (250)	-.1601 (119) *
Grip Left	-.1612 (502) ***	.0862 (226)	-.0803 (276)	-.2019 (150) **	-.1715 (237) **	-.1762 (102) *
Grip Right	-.1428 (504) ***	.1159 (228) *	-.0427 (276)	-.1486 (152) *	-.1604 (238) **	-.1894 (101) *
Shape Assembly	.1234 (529) **	.2094 (238) ***	.1392 (291) **	.0793 (163)	.1330 (241) *	.0992 (111)
Analytical Reasoning	.3269 (533) ***	.3570 (240) ***	.2843 (293) ***	.1635 (166) *	.3964 (242) ***	.3558 (111) ***

* The number in parenthesis is sample size.

* p < .05

** p < .01

*** p < .001

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TABLE 16

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FISHER'S Z VALUES FOR TESTING DIFFERENTIAL GROUP VALIDITY
FOR EACH BAB TEST WITH GRADE POINT AVERAGE

BAB TEST	MALE-FEMALE	BLACK-WHITE	BLACK-HISPANIC	WHITE-HISPANIC
Clerical	0.367	-0.350	0.688	0.976
Idea Fluency	-1.278	0.371	-1.652	-1.957
Tonal Memory	-0.630	1.280	0.563	-0.682
Pitch	-1.049	0.453	0.297	-0.143
Rhythm	0.463	0.348	1.271	0.933
Inductive Reasoning	1.293	-1.247	-0.365	0.663
Word Assoc.	0.723	2.783**	0.042	-2.235*
Paper Folding	0.969	0.930	2.002*	0.926
Vocab.	0.842	-0.835	0.807	1.495
Ideaphoria	0.130	-0.247	-1.596	-1.392
F.D. Left	0.154	-0.810	-1.151	-0.482
F.D. Right	0.024	0.235	2.777**	2.582**
Grip Left	-1.683	0.450	1.903	1.532
Grip Right	1.840	-0.295	-0.208	0.031
Shape Assembly	0.581	-2.969**	0.315	2.707**
Analytical Reasoning	0.819	-0.538	-0.161	0.281
Writing Speed	0.925	-2.515*	-1.675	0.380

* $p < .05$ ** $p < .01$

TABLE 17

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DAT INTERCORRELATION MATRIX (N=84)

DAT TEST	Verbal Reasoning	Clerical	Spatial Reasoning	Language Usage	Numerical Ability	Abstract Reasoning	Mechanical Reasoning	Spelling
Verbal Reasoning	----							
Clerical	.06	----						
Spatial Reasoning	.65	.14	----					
Language Usage	.76	.21	.57	----				
Numerical Ability	.77	.28	.66	.68	----			
Abstract Reasoning	.65	.22	.52	.54	.66	----		
Mechanical Reasoning	.57	.13	.49	.44	.58	.60	----	
Spelling	.62	.24	.40	.77	.59	.41	.25	----

TABLE 18

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CONSTRUCT VALIDITY OF THE BALL APTITUDE
BATTERY WITH THE DIFFERENTIAL APTITUDE TESTS^a

DAT BAB	Verbal Reasoning	Clerical	Spatial Reasoning	Language Usage	Numerical Ability	Abstract Reasoning	Mechanical Reasoning	Spelling
Clerical	.31 (83) **	.19 (83) *	.13 (83)	.25 (83) *	.28 (83) **	.14 (83)	-.05 (83)	.50 (83) **
Idea Fluency	.34 (84) **	-.06 (84)	.13 (84)	.14 (84)	.18 (84)	.23 (84) *	.08 (84)	.02 (84)
Induc. Reasoning	.32 (84) **	.17 (84)	.37 (84) **	.32 (84) **	.33 (84) **	.42 (84) **	.39 (84) **	.12 (84)
Word Assoc.	.22 (83) *	-.03 (83)	.08 (83)	.05 (83)	.16 (83)	.15 (83)	.05 (83)	.07 (83)
Writing Speed	.12 (83)	.30 (83) **	.05 (83)	-.00 (83)	.14 (83)	.27 (83) *	.23 (83) *	.11 (83)
Paper Folding	.59 (84) **	.13 (84)	.60 (84) **	.48 (84) **	.56 (84) **	.56 (84) **	.56 (84) **	.29 (84) **
Vocabulary	.73 (84) **	.08 (84)	.43 (84) **	.59 (84) **	.51 (84) **	.50 (84) **	.37 (84) **	.40 (84) **
Ideaphoria	.21 (83) *	.06 (83)	.07 (83)	.11 (83)	.12 (83)	.22 (83) *	.00 (83)	.06 (83)
F.D. Left	.04 (83)	.15 (83)	.04 (83)	.02 (83)	.15 (83)	.19 (83) *	.15 (83)	.10 (83)
F.D. Right	.04 (82)	.23 (82) *	.04 (82)	.00 (82)	.19 (82) *	.10 (82)	.01 (82)	.10 (82)
Grip Left	.04 (62)	.07 (62)	.02 (62)	-.15 (62)	.14 (62)	.27 (62) *	.48 (62) **	-.17 (62)
Grip Right	.11 (62)	.05 (62)	.00 (62)	-.10 (62)	.17 (62)	.24 (62) *	.49 (62) **	-.11 (62)
Shape Assembly	.41 (64) **	.14 (64)	.47 (64) **	.32 (64) **	.55 (64) **	.43 (64) **	.61 (64) **	.03 (64)
Analy. Reasoning	.64 (63) **	.07 (63)	.45 (63) **	.49 (63) **	.56 (63) **	.41 (63) **	.53 (63) **	.30 (63) **

^aThe number in parenthesis is sample size.

* $p < .05$

** $p < .01$

TABLE 19

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ACT INTERCORRELATION MATRIX (N=136)

ACT TEST	ENGLISH	MATH	SOCIAL STUDIES	NATURAL SCIENCE	COMP.
ENGLISH	----				
MATH	.68	----			
SOCIAL STUDIES	.76	.73	----		
NATURAL SCIENCE	.70	.74	.84	----	
COMP.	.44	.52	.63	.64	----

CONSTRUCT VALIDITY OF THE BALL APTITUDE BATTERY
WITH THE AMERICAN COLLEGE TESTS (ACT)^a

BAB TEST	ACT ENGLISH	ACT MATH	ACT SOCIAL STUDIES	ACT NATURAL SCIENCE	ACT COMPOSITE
Clerical	.28 (136)**	.31 (134)**	.18 (134)*	.26 (134)**	.20 (134)**
Idea Fluency	.43 (134)**	.36 (132)**	.42 (132)**	.40 (132)**	.31 (132)**
Tonal Memory	.46 (47)**	.45 (47)**	.45 (47)**	.55 (47)**	.52 (47)**
Pitch	.68 (47)**	.46 (47)**	.49 (47)**	.60 (47)**	.54 (47)**
Rhythm	.17 (47)	.28 (47)*	.11 (47)	.16 (47)	.19 (47)
Induc. Reasoning	.30 (135)**	.28 (133)**	.32 (133)**	.34 (133)**	.24 (133)**
Word Assoc.	.20 (136)**	.08 (134)	.18 (134)*	.15 (134)*	.10 (134)
Writing Speed	.03 (129)	-.02 (127)	-.01 (127)	.03 (127)	.00 (127)
Paper Folding	.47 (136)**	.61 (134)**	.54 (134)**	.61 (134)**	.48 (134)**
Vocabulary	.65 (136)**	.60 (134)**	.73 (134)**	.66 (134)**	.47 (134)**
Ideaphoria	.25 (136)**	.43 (134)**	.28 (134)**	.39 (134)**	.29 (134)**
F.D. Left	.00 (135)	.05 (133)	.07 (133)	.09 (133)	.05 (133)
F.D. Right	.02 (135)	.00 (133)	-.00 (133)	.03 (133)	.10 (133)
Grip Left	-.08 (117)	.10 (116)	.03 (116)	.05 (116)	-.04 (116)
Grip Right	-.06 (117)	.15 (116)	.10 (116)	.10 (116)	.02 (116)
Shape Assembly	.37 (127)**	.46 (126)**	.39 (126)**	.48 (126)**	.37 (126)**
Anal. Reasoning	.62 (129)**	.57 (128)**	.67 (128)**	.66 (128)**	.57 (128)**

^a The number in parenthesis is sample size.

* $p < .05$

** $p < .01$

TABLE 21

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VALIDITY COEFFICIENTS FOR EACH ACT TEST
WITH EACH ACADEMIC CRITERIA^a

BAB TEST	ENGLISH	MATH	ECONOMIC	BIOLOGY	PHYSICS	CHEM	SCI AVE	SOC STU	FOR LANG	GPA
ACT English	06 ^b (136)	13 (136)	01 (55)	22 (111) *	30 (51) *	05 (64)	22 (119) **	29 (136) **	23 (85) *	29 (103) **
ACT Math	14 (134)	22 (134) **	14 (53)	24 (109)	33 (50) **	31 (63) **	29 (117) **	31 (134) **	31 (85) **	34 (102) **
ACT Social Studies	14 (134)	14 (134)	08 (53)	24 (109) **	23 (50)	15 (63)	19 (117) *	30 (134) **	24 (85) *	29 (102) **
ACT Natural Science	20 (134) *	13 (134)	12 (53)	30 (109) **	19 (50)	19 (63)	23 (117) **	30 (134) **	26 (85) **	34 (102) **
ACT Comp.	23 (134) **	33 (134) **	39 (53)	41 (109) **	- 21 (50)	16 (63)	14 (117)	28 (134) **	20 (85) *	35 (102) **

^a The number in parenthesis is sample size used to calculate respective validity coefficient.

^b Decimal points are omitted.

* $p < .05$

** $p < .01$